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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/540,834	06/23/2005	Hiroynki Sato	10936-90	2146
24256 7590 09/24/2008 DINSMORE & SHOHL, LLP 1900 CHEMED CENTER 255 EAST FIFTH STREET CINCINNATI, OH 45202				
EXAMINER				
TISCHLER, FRANCES				
ART UNIT		PAPER NUMBER		
1796				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/540,834

Applicant(s)

SATO ET AL.

Examiner

Frances Tischler

Art Unit

1796

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 June 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SF/ICE)
Paper No(s)/Mail Date 9/15/05, 6/8/07.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 4 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
3. Claim 4 recites the limitation "the liquid components (D1 and D2)" in line 4. There is insufficient antecedent basis for this limitation in the claim, since claim 4 depends on claim 2, and said limitation is found in claim 3.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. **Claims 1 – 4, 9 – 11 and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Iwasaki (US 4,769,442).**

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6. Regarding claims 1 and 10: Iwasaki discloses (2:4 – 59, 4:1 – 27, 5:4 – 42) a process for producing a polyarylene sulfide (PAS) comprising:

- reacting an alkali sulfide and a di-chloroaromatic compound/di-halo aromatic compound in N-methylpyrrolidone(NMP)/aromatic amide solvent,
- separating the polymer slurry from the solution using a sieve,
- washing the separated PAS polymer with an organic solvent, preferably acetone,
- recovering the organic solvent,
- using the organic solvent repeatedly by first recovering it by distillation or by passing it through a column to be purified, part or all of which can then be used on the polymer slurry in the separation step.

Applicant claims adding alkali metal hydroxide as needed. This is needed when metal hydrosulfides are used. Since Iwasaki discloses the use of alkali sulfide, there is no need to add the alkali metal hydroxide. Typically, alkali sulfide is made in situ using metal hydrosulfide and alkali metal hydroxide, both of which would inherently be present in Iwasaki's invention in order to obtain the disclosed alkali sulfide. The process of distilling the solvent and the process of passing the solvent through a column to purify it read on applicant's claim of purifying the solvent recovered.

7. Regarding claims 2 – 4: Iwasaki discloses (2:2 – 35) that the polymer slurry is sifted while being washed with the organic solvent. The sieve acts to

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separate the polymer from the solution (NMP, acetone, and other soluble by-products).

8. Regarding claim 9: Iwasaki discloses (4:23 – 27) recycling the used acetone after distillation, which means the acetone is being purified. Iwasaki also discloses (5:38 – 42) purifying the acetone by passing it through a column. The column separates the various compounds present, thus purifying the acetone. Iwasaki is silent on the amount of alkaline compound left in the purified acetone; however it would inherently be lowered by the process of purification, reading on applicant's claim.

9. Regarding claim 11: Iwasaki is silent on methylamine as a by-product. However, since Iwasaki's reaction components and process are substantially identical to applicant's, methylamine is inherently one of the by-products.

10. Regarding claim 14: Iwasaki discloses (3:35 – 59) a two stage polymerization process comprising reacting the dihaloaromatic compound in a conversion of 50 – 98 mole% with alkali sulfide in a solvent consisting of 0.2 – 5 liters of NMP and 0.5 – 2.4 moles of water per mole of sulfide at a temperature of 180 – 235°C, then adding water to amounts of 2.5 – 7 moles per mole of sulfide at temperatures of 245 – 290°C.

Claim Rejections - 35 USC § 102/103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

13. **Claims 12, 15, 17 and 18 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Iwasaki (US 4,769,442).**

14. Regarding claims 12, 15, 17 and 18: Iwasaki discloses washing the polyarylene sulfide obtained by polymerization in an organic amide solvent, wherein the washing was done with an organic solvent (2:4 – 34, 4:1 – 27). The alkaline compound present in the solvent is inherently lowered by the fact that Iwasaki passes the solvent through distillation/column. Iwasaki is silent on the yellow index of the polymer. However, since Iwasaki's PAS polymer, the process

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of making it and its washing treatment are substantially identical to the instant application, Iwasaki's yellow index would inherently be the same as in the instant application. A chemical and its properties are inseparable. See MPEP 2112.01: *In re Sparta*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir.1990). See also *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977). "Where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established." Moreover, the case law has held that "A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie*, 559 F.2d618, 195 USPQ 6 (CCPA 1977). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have varied the column parameters and the washing parameters as necessary through routine optimization to obtain the desired yellow index and ppm of the alkaline compound.

Claim Rejections - 35 USC § 103

15. Claims 5 – 7, 13, 16 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwasaki (US 4,769,442) in view of Miyahara (US 5,840,830), hereinafter Miyahara '830, and further in view of Miyahara

(WO/03/048231, relying on the English translation of US2005/0087215), hereinafter Miyahara '215.

16. Iwasaki's disclosure is discussed above and is incorporated herein by reference.

Iwasaki fails to teach the use of an inorganic acid/HCl in the purification step and the dehydration of the sulfide/amide solvent mixture.

17. **Miyahara '830** discloses (4:35 – 43) a process for producing a polyarylene sulfide by polymerizing a dihalo-aromatic compound with an alkali metal sulfide in an organic amide solvent such as NMP (6:11 – 13). An alkali metal hydrosulfide can also be used in the presence of an alkali metal hydroxide (4:61 – 64). Prior to the polymerization step, the organic amide solvent and the sulfur source is heated and dehydrated to control the water content in the mixture (6:29 – 40 and 66 – end, 7:1 – 32). The polymerization is conducted by a two stage process where the temperature is first raised to 180 – 235°C and water is present in an amount of 0.5 – 2.4 moles per moles of sulfide to give a conversion of dihalo-aromatic compound of 50 – 98 mole%, then water is added to 2.5 – 7 mole per mole of sulfide at temperatures of 245 – 290°C (9:23 – 34). Miyahara '830 discloses filtering, sifting and washing the PAS polymer produced by the above method. The washing is done with an organic solvent, such as the solvent used for the polymerization, or a ketone, such as acetone (9:49 – 63, 11:21 – 31). The polymer formed can also be treated with an acid (9:62 – 63).

18. **Miyahara '215** discloses a process of polymerizing polyarylene sulfide from an alkali sulfide or alkali hydrosulfide with alkali hydroxide, an aromatic dihalide compound and a polar organic solvent, such as NMP ([0025], [0027, [0031]). The polymer is separated from the liquid through sieving ([0015]). Washing of the polymer is done by successive methods which include washing with acetone ([0044]), recovering the acetone through distillation ([0045], [0046], [0060]). The washing is also treated with an acid, specifically HCl, added to the solvent ([0047], [0048]). The acid treatment is effective for increasing the crystallization temperature and speed ([0047]).

19. Iwasaki fails to disclose the use of an inorganic acid in the washing/purification step. Miyahara '830 discloses that the polymer can be treated with an acid during the washing/purification step and Miyahara '215 discloses that this acid can be HCl. It would have been obvious to one of ordinary skill in the art to have used Miyahara '830's acid in Iwasaki's cleaning treatment of PAS since in both cases the reaction, the process and the by-products are the same and Iwasaki expressly purifies the solvent. It would also have been obvious to one of ordinary skill in the art to have used Miyahara '215's HCl as Miyahara '830's acid or used Miyahara '215's HCl in Iwasaki's process for the same stated reasons. Iwasaki's treatment with HCl would raise the crystallization temperature of the polymer as disclosed by Miyahara '215.

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20. The exact crystallization temperature, the yellow index, the pH lowering of the liquid after the addition of acid, and the amount of alkaline by-product left in the solvent can be optimized for the desired results. The case law has held that "A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. In re Antonie, 559 F.2d618, 195 USPQ 6 (CCPA 1977). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have varied the amount or strength of the acid or the number and strength of washes, as necessary through routine optimization to obtain the desired results.

21. Iwasaki is silent on a step of heating and dehydrating the mixture prior to polymerization. Miyahara '830 discloses such process in order to control the water content. It would have been obvious to one of ordinary skill in the art to dehydrate Iwasaki's mixture as disclosed by Miyahara '830 since both are disclosing the same reaction and process to obtain the same results and Iwasaki discloses that, during the first stage of the polymerization, the water content is 0.5 – 2.0 moles per mole of sulfur source, indicating that water content is an important factor and is being controlled.

22. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Iwasaki (US 4,769,442) in view of Miyahara (US 5,840,830) and further in view of Water Encyclopedia, pages 350 – 352.

23. Iwasaki's and Miyahara's disclosures are discussed above and are incorporated herein by reference.

24. Iwasaki discloses passing the solvent through a column for purification, but is silent on activated carbon comprising the column. Passing solutions over activated carbon for removal of organic impurities is well known in the art, as disclosed by the Water Encyclopedia on pages 350 – 352. Therefore, it would have been obvious to one of ordinary skill in the art to have used activated carbon on Iwasaki's or Miyahara's solvent cleaning since organic by-products, such as methylamine, are expected to be eliminated from the solvent in order to purify the latter.

Information Disclosure Statement

25. The information disclosure statements filed on 9/15/05 and 6/8/07 fail to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. They have been placed in the application file, but some of the information referred to therein has not been provided to the Examiner. A strike-through has been placed through said references.

Examiner Information

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Frances Tischler whose telephone number is (571)270-5458. The examiner can normally be reached on Monday-Friday 7:30AM - 5:00 PM; off every other Friday.

27. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jim Seileck can be reached on 571-272-1078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

28. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ Irina S. Zemel/
Primary Examiner, Art Unit 1796

Frances Tischler
Examiner
Art Unit 1796

/FT/

